

What is claimed is:

1. A nonvolatile semiconductor memory device, comprising:
a semiconductor substrate having thereon a plurality of diffusion layers for forming bit lines and a plurality of channel regions disposed between said adjacent diffusion layers;
5 an insulating film formed on said semiconductor substrate for trapping electric charge;
an electrical conductive film formed on said insulating film for forming a word line,
wherein said insulating film is generally flatly formed
10 on both said diffusion layers and said channel regions.
2. The nonvolatile semiconductor memory device according to claim 1, wherein said electrical conductive film comprises at least a first electrical conductive film formed on said insulating film on said channel regions and a second electrical conductive film covering said first electrical conductive film.
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3. The nonvolatile semiconductor memory device according to claim 1, further comprising an oxide film formed on said insulating film on said diffusion layers, said oxide film being formed by oxidizing said first electrical conductive film.
4. A nonvolatile semiconductor memory device, comprising:
a semiconductor substrate having thereon a plurality of diffusion layers for forming bit lines and a plurality of channel regions disposed between said adjacent diffusion layers;
5 an insulating film formed on said semiconductor substrate for trapping electric charge;
an electrical conductive film formed on said insulating

film for forming a word line,

wherein said insulating film is generally flatly formed on
10 said channel region, and

wherein said electrical conductive film comprises at least
a first electrical conductive film formed on said insulating film
on said channel region and a second electrical conductive film
covering said first electrical conductive film.

5. The nonvolatile semiconductor memory device according to
claim 4, further comprising an oxide film on said diffusion layer,
said oxide film being formed by oxidizing said first electrical
conductive film and said insulating film.

6. The nonvolatile semiconductor memory device according to
claim 4, wherein said insulating film is formed such that the
thickness of said insulating film is smaller on said diffusion
layers than the thickness thereof on said channel regions.

7. The nonvolatile semiconductor memory device according to
claim 2, wherein said first electrical conductive film includes
polycrystalline silicon, amorphous silicon, or a silicon
compound, and wherein said second electrical conductive film
5 includes polysilicon or refractory metal silicide.

8. The nonvolatile semiconductor memory device according to
claim 4, wherein said first electrical conductive film includes
polycrystalline silicon, amorphous silicon, or a silicon compound,
and wherein said second electrical conductive film includes
5 polysilicon or refractory metal silicide.

9. The nonvolatile semiconductor memory device according to
claim 1, wherein said insulating film comprises ON films, said

ON films being formed by depositing a silicon oxide film and subsequently depositing a silicon nitride film thereon, or ONO

5 films, said ONO films being formed by depositing a silicon oxide film, subsequently depositing a silicon nitride film thereon and subsequently depositing a silicon oxide film thereon.

10. The nonvolatile semiconductor memory device according to claim 4, wherein said insulating film comprises ON films, said ON films being formed by depositing a silicon oxide film and subsequently depositing a silicon nitride film thereon, or ONO

5 films, said ONO films being formed by depositing a silicon oxide film, subsequently depositing a silicon nitride film thereon and subsequently depositing a silicon oxide film thereon.

11. The nonvolatile semiconductor memory device according to claim 9, wherein parts of said silicon nitride film of said ON films or said ONO films formed on said diffusion layers are transmuted by ion-implantation.

12. The nonvolatile semiconductor memory device according to claim 10, wherein parts of said silicon nitride film of said ON films or said ONO films formed on said diffusion layers are transmuted by ion-implantation.

13. A method for manufacturing a nonvolatile semiconductor memory device, comprising:

forming an insulating film on a semiconductor substrate;

forming a first electrical conductive film on said

5 insulating film; and

implanting an impurity into said semiconductor substrate through at least said insulating film to form a diffusion layer

on a surface of said semiconductor substrate.

14. The method according to claim 13, wherein said impurity is implanted through said first electrical conductive film and said insulating film in said implanting the impurity.

15. The method according to claim 13, further comprising selectively removing said first electrical conductive film before said implanting the impurity, wherein said impurity is implanted through said insulating film into the region of said 5 semiconductor substrate where said first electrical conductive film thereon is removed in said implanting the impurity.

16. The method according to claim 13, wherein said first electrical conductive film on said diffusion layer is, or said insulating film and said first electrical conductive film are transformed by thermal oxidization or radical oxidization to an 5 oxide film.

17. The method according to claim 13, wherein said insulating film comprises ON films or ONO films, said ON films being formed by depositing a silicon oxide film and subsequently depositing a silicon nitride film thereon, and said ONO films being formed 5 by depositing a silicon oxide film, subsequently depositing a silicon nitride film thereon and subsequently depositing a silicon oxide film thereon.

18. The method according to claim 17, wherein said impurity is implanted through at least said silicon nitride film of said ON films or said ONO films to transmute parts of said silicon nitride film formed on said diffusion layers.

19. A method for manufacturing a nonvolatile semiconductor

memory device, comprising:

forming an insulating film on a silicon substrate;

5 forming a first electrical conductive film on said insulating film;

forming a patterned mask on said first electrical conductive film;

implanting via said patterned mask an impurity thereto through said first electrical conductive film and said

10 insulating film to form a diffusion layer on a surface of said silicon substrate for forming a bit line;

removing said patterned mask;

forming a second electrical conductive film on said first electrical conductive film; and

15 forming a word line comprising a dual-layer structure of said first electrical conductive film and said second electrical conductive film.

20. A method for manufacturing a nonvolatile semiconductor memory device, comprising:

forming an insulating film;

5 forming a first electrical conductive film on said insulating film;

forming a patterned mask on said first electrical conductive film;

removing an exposed portion of said first electrical conductive film via said patterned mask;

10 implanting via said patterned mask an impurity thereto through said insulating film to form a diffusion layer on a surface

of said silicon substrate for forming a bit line;

removing said patterned mask;

15 forming a second electrical conductive film on said first electrical conductive film; and

forming a word line comprising a dual-layer structure of said first electrical conductive film and said second electrical conductive film.

21. A method for manufacturing a nonvolatile semiconductor memory device, comprising:

forming an insulating film;

5 forming a first electrical conductive film on said insulating film;

forming a patterned mask on said first electrical conductive film;

10 implanting via said patterned mask an impurity thereto through said first electrical conductive film and said insulating film to form a diffusion layer on a surface of said silicon substrate for forming a bit line;

oxidizing the exposed portion of said first electrical conductive film by thermal oxidization or radical oxidization to form an oxide film on said insulating film;

15 removing said patterned mask;

forming a second electrical conductive film on said first electrical conductive film; and

20 forming a word line comprising a dual-layer structure of said first electrical conductive film and said second electrical conductive film.

22. A method for manufacturing a nonvolatile semiconductor memory device, comprising:

forming an insulating film;

5 forming a first electrical conductive film on said insulating film;

forming a patterned mask on said first electrical conductive film;

10 implanting via said patterned mask an impurity thereto through said first electrical conductive film and said insulating film to form a diffusion layer on a surface of said silicon substrate for forming a bit line;

15 oxidizing the exposed portion of said first electrical conductive film and said insulating film underlying thereof by thermal oxidization or radical oxidization to form an oxide film on said diffusion layer;

removing said patterned mask;

forming a second electrical conductive film on said first electrical conductive film; and

20 forming a word line comprising a dual-layer structure of said first electrical conductive film and said second electrical conductive film.

23. A method for manufacturing a nonvolatile semiconductor memory device, comprising:

forming an insulating film;

5 forming a first electrical conductive film on said insulating film;

forming a patterned mask on said first electrical

conductive film;

10 forming a sidewall film having a predetermined thickness on a sidewall of said patterned mask by depositing a silicon nitride film and etching back thereof;

implanting via said patterned mask an impurity thereto through said first electrical conductive film and said insulating film to form a diffusion layer on a surface of said silicon substrate for forming a bit line, an opening width of 15 said patterned mask being limited by said sidewall;

removing said patterned mask and said sidewall film;

forming a second electrical conductive film on said first electrical conductive film; and

20 forming a word line comprising a dual-layer structure of said first electrical conductive film and said second electrical conductive film.

24. A method for manufacturing a nonvolatile semiconductor memory device, comprising:

forming an insulating film;

5 forming a first electrical conductive film on said insulating film;

forming a patterned mask on said first electrical conductive film;

removing said exposed first electrical conductive film via said patterned mask to expose said insulating film;

10 implanting via said patterned mask an impurity through said insulating film thereto to form a diffusion layer on a surface of said silicon substrate for forming a bit line;

removing said exposed insulating film via said patterned mask;

15 forming an oxide film on at least said diffusion layer and sidewalls of said insulating film and said first electrical conductive film, said oxide film having a thickness that is less than the thickness of said insulating film;

removing said patterned mask;

20 forming a second electrical conductive film on said first electrical conductive film; and

forming a word line comprising a dual-layer structure of said first electrical conductive film and said second electrical conductive film.

25. A method for manufacturing a nonvolatile semiconductor memory device, comprising:

forming an insulating film;

5 forming a first electrical conductive film on said insulating film;

forming a patterned mask on said first electrical conductive film;

removing said exposed first electrical conductive film and said insulating film underlying thereof via said patterned mask;

10 forming an oxide film on at least said diffusion layer and on sidewalls of said insulating film and said first electrical conductive film, said oxide film having a thickness that is less than the thickness of said insulating film;

implanting via said patterned mask an impurity thereto
15 through said oxide film to form a diffusion layer on a surface

of said silicon substrate for forming a bit line;

removing said patterned mask;

forming a second electrical conductive film on said first
electrical conductive film; and

20 forming a word line comprising a dual-layer structure of
said first electrical conductive film and said second electrical
conductive film.